The investigation area i.e., Elappara, Vagamon and Peermade sub-watersheds, forms a continuous stretch of land that belongs to the Western Ghats region of Kerala, South India. The pristine nature of the water resources of this region is greatly affected by various anthropogenic activities including agricultural practices with the application of chemical fertilizers, pesticides and various developmental activities including that of tourism. Study of highland sub-watersheds are of much significance because even a small change in the upper region can drastically affect the midland and the lowland regions of the river basin.

The present investigation is a critical evaluation of the morphometric characteristics of the terrain of the three sub-watersheds that belong to three different river basins and establishment of the hydrological scenario of the respective regions and their comparison. Morphometric analysis, monitoring of physico-chemical characteristics of ground water and ground water fluctuation studies coupled with rainfall data were also carried out.

A critical evaluation and assessment of the morphometric parameters of three sub-watersheds have been achieved through the measurement of linear, aerial and relief aspects of sub-watersheds using GIS techniques. A drainage map is prepared using Arc GIS 9.2 software. Morphometric analysis has been carried out for stream order(U), stream length (Lu), mean stream length (Lsm), bifurcation ratio (Rb), stream length ratio (Rl) (*linear parameters*), basin relief (Bh), relief ratio (Rh), ruggedness number (Rn) (*relief parameters*), drainage density (Dd), stream frequency (Fs), elongation ratio (Re), Circulatory ratio (Rc), form factor (Rf), texture ratio (T), length of overland flow (lof), constant channel maintenance(C) (*aerial parameters*).

Micro watershed prioritization i.e., the ranking of different micro-watersheds of the Elappara, Vagamon and Peermade sub-watersheds on the basis of water holding capacity forms an integral part of the present investigation. Morphometric parameters such as bifurcation ratio, drainage density, stream frequency, texture ratio, length of overland flow and constant channel maintenance of delineated micro-watersheds were separately calculated, using Spatial Analyst tool. Integrated final prioritized maps for all the three sub-watersheds were prepared. Areas representing ‘poor to low’, ‘low to medium’, ‘medium to high’ and ‘high to very high’ zones were calculated and compared.

In order to understand and establish the hydrological scenario of the three sub-watersheds, season wise water table fluctuation studies and measurements were carried out during the period 2010 June to 2011 May. Water level data were collected from selected dug wells of the sub-watersheds and were compared with each other and also with the rainfall data. The long term trend regarding rainfall data and groundwater level fluctuations were established through hydrographs.

Physico-chemical analyses of season wise ground water samples from all the three sub-watersheds were studied. Parameters such as, pH, TDS, EC, Total alkalinity, acidity, total hardness, chloride and phosphate were used to calculate Water Quality Index (WQI) in weighted arithmetic index method. They are classified as 'excellent', 'good', 'poor', 'very poor' and 'unfit for drinking'. Spatial distribution maps were also prepared for all the three sub-watersheds by adding WQI index values as attribute data.

The statistical analysis of the study provides information about water chemistry parameters. Box plots of each parameter with respect to watersheds and seasons indicate the degree of dispersion of the data graphically. Standard deviation, interprets the variability within the data. One-way ANOVA for each parameter, assesses whether differences are significant with respect to sub-watersheds and seasons.

An undisturbed watershed keeps the untouched nature of ground water, but any small change may seriously affect the quality and quantity. If it is contaminated, that will be retained in the system for many more years. Thus continuous monitoring and evaluation of the changes in the water quality and level is of much significance. Advanced technologies like GIS and satellite imageries, help in the quantitative and qualitative assessment of geometry, network of drainage, nature of bedrock, infiltration capacity, surface runoff, etc. In the present study morphometric analysis, water table studies and monitoring physico-chemical characteristics of ground water were used to establish the ground water scenario of the region under investigation. Thus the present study i.e., terrain evaluation and comparative study of Elappara, Vagamon and Peermade sub-watersheds and its outcome is very useful in applying proper planning and watershed management practices. Moreover the present comprehensive and extensive study will help the planners to adopt a systematic approach in sustainable watershed development.